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United States
Department of
Agriculture

**Animal and
Plant Health
Inspection
Service**

**Veterinary
Services**

APHIS 91-39

National Tick Surveillance Program

Calendar Year 1987

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National Tick Surveillance Program
Calendar Year 1987

During calendar year 1987, the collection and submission of ticks from native and imported animals, plus plant and animal material, was 30.63 percent greater than in 1986. There were 10,214 collections in 1987, 7,819 collections in 1986, 5,037 in 1985, and 7,213 in 1984.

Antigua Pilot Tropical Bont Tick Eradication Project

During 1987 considerable progress was made in the organization of a Caribbean-wide program to eradicate *Amblyomma variegatum,* the tropical bont tick, and its associated diseases (heartwater and acute dermatophilosis) from the area. In March 1987, the feasibility proposal written by experts from the U.S. Department of Agriculture (USDA) and the Inter-American Institute for Cooperation on Agriculture (IICA), with the input of consultants from a number of international organizations, was finished and widely distributed. It was discussed at a workshop held in Barbados, West Indies, in March, where representatives from many Caribbean Islands, USDA, U.S. Agency for International Development (USAID), IICA, Food and Agriculture Organization (FAO), and other public and private organizations reviewed the document. The proposal described the present situation with the tick and diseases in the Caribbean. The group passed four resolutions: (1) establish an *Amblyomma* Program Council under the purview of the English-speaking Caribbean Community (CARICOM); (2) establish a pilot project to demonstate tick eradication techniques on an island; (3) convene a donor's conference; and (4) seek emergency support for current tropical bont tick control activities on infested islands.

In September 1987, the $2 million that Congress appropriated to USAID for a tropical bont tick program in the Caribbean was transferred to USDA in order to carry out a demonstration tick eradication program on Antigua. This demonstration project has three main facets: (1) an eradication component to be carried out by the Office of International Cooperation and Development (OICD) and USDA; (2) a research, information, and evaluation component to be carried out by OICD-USDA; and (3) a policy and strategy component to be carried out by USAID. Some of the funds given to OICD-USDA will be transferred to ARS-USDA for research on the biology and control of the tropical bont tick in the Caribbean. Other research will be on the economic aspects of eradication and the effects of the acaricides on wildlife.

The eradication component consists of four phases: (1) Planning Phase; (2) Preoperation Phase of 6 months, which includes education, training, surveillance, construction, and procurement; (3) Eradication Phase, which consists of application of acaricides (amitraz or permethrin) to all cattle, sheep, goats, and horses every 2 weeks for 2 years; and (4) Posteradication Phase, which consists of a followup surveillance for 6 months to determine if the ticks have been eliminated from the island. The eradication component is proposed to begin in 1988.

In November 1987, at a meeting in Rome, the Standing Committee of the Ministries of Agriculture of CARICOM established an *Amblyomma* Steering Committee. This committee will provide a focus for implementing a coordinated *Amblyomma* eradication program throughout the Caribbean.

Updated on *Boophilus microplus* Eradication in Puerto Rico

The USDA and Puerto Rico Department of Agriculture continued their cooperative efforts to eradicate *Boophilus microplus* from the island. The program maintained an average of 9,000 premises under treatment (average number of animals per premise was 11). In excess of 2.5 million individual animal treatments were administered during the year.

The computerized field data system is in operation in two of the three eradication zones. The third system will be established by mid-1988. The system maintains such data as the location of the premises, number and type of animals, status in the treatment cycle, and changes in animal numbers or in the infestation status. The system permits program managers to rapidly assess the status of a premise, region, or the entire island. This allows more effective planning, budgeting, and execution of the eradication program.

The new eradication zone established last year is in full operation. Additionally, program success has allowed the Arecibo Region to move some resources forward into new areas toward the east. The other two regions (Guanica and Juncos) are expected to expand toward the center of the island in 1988. Approximately 7,000 premises were declared free during 1987.

Funding for the *Boophilus* eradication program, as in recent years, came from three sources: a Food and Nutrition Service (USDA-FNS) block grant, $8.6 million; Veterinary Services (USDA-APHIS-VS), $1.5 million; and the Commonwealth of Puerto Rico Department of Agriculture (PRDA), $1.0 million. This cooperative funding permitted major purchases for the necessary program expansion and to retain the flexibility to meet day-to-day demands.

Status of *Amblyomma variegatum* in Puerto Rico

The main island of Puerto Rico is considered free of *A. variegatum.* A Commonwealth imposed quarantine is in effect for the smaller island of Culebra, where *Amblyomma variegatum* is known to be present. Treatment of livestock on Culebra is mandatory and performed on a routine basis, but rugged terrain has hampered the gathering of animals and slowed eradication efforts. Movement of animals off the island is permitted only when the shipment is going directly to slaughter and only following inspection to ensure tick-free status and application of a pesticide treatment.

Amblyomma variegatum Reintroduced in the U.S. Virgin Islands

Amblyomma variegatum, the tropical bont tick, was discovered on St. Croix, U.S. Virgin Islands, during July 1987. This tick had been considered eradicated since 1970, when the previous eradication program consisting of quarantine, rigorous individual animal treatment with coumaphos, and premises treatment with sprayable carbaryl came to an end. It is of interest that a few isolated male ticks were discovered sporadically on St. Croix after 1972, but no evidence of infestation or further spread could be found.

The current outbreak is limited to one area of about 31 acres of brush pasture on which cattle, horses, swine, dogs, and chickens roamed freely, as well as mongooses and a few head of deer. Several cattle had died of a condition resembling dermatophilosis. Clinical cases of dermatophilosis were subsequently observed. A 5-acre portion of the premise was found to be heavily infested and has been treated twice with sprayable chlorpyrifos.

Cattle, horses, swine, and dogs have been under quarantine and regular biweekly treatment with coumaphos. Cattle, swine, and chickens have now been removed from the premise. The biweekly scratch and treatment of all adjacent animals, as well as the trapping of chickens and mongooses for surveillance and elimination, is continuing. The hunting of deer has, thus far, been unsuccessful. The origin of this infestation is not clear.

Boophilus Research Highlights for 1987 from the Cattle Fever Tick Research Laboratory, USDA, Agricultural Research Service Kerrville and Mission, Texas

Research began several years ago on organophosphate (OP)-resistant *Boophilus microplus* from Mexico and continued with investigations on the biochemical mechanisms accountable for the altered susceptibility of the ticks to coumaphos and related acaricides. One study determined that in the resistant strain, which originated near Tuxtla, Chiapas, Mexico, two types of the enzyme acetylcholinesterase (AChE) were present. One form of AChE was prone to inhibition by OP's, but the activity of the second form of AChE was less affected by these acaricides. These experimental results suggest that an altered AChE with decreased sensitivity to inhibition is probably an important factor in the altered susceptibility of the *B. microplus* in parts of Mexico to coumaphos, chlorfenvinphos, and related acaricides. A parallel investigation determined that in resistant ticks there was also enhanced metabolic detoxification of coumaphos and toxic metabolites of this compound.

As the age of tick larvae increases, the ticks undergo undetermined biochemical and physiological changes that result in increased susceptibility to pesticides and lowered survival rates. It was hypothesized that a reduced quantity of AChE in older tick larvae is related to their increased susceptibility to acaricides. But, experimental evidence from investigations of the AChE of five species of ticks, including *B. microplus,* determined that in these ticks amounts of AChE actually increased with age.

Because of an apparent failure of amitraz to control *B. microplus* on cattle in the vicinity of Juncos, Puerto Rico, engorged females of this species were collected and shipped to the Cattle Fever Tick Research Laboratory for tests of their susceptibility. Groups of calves infested either with F_1 larval ticks from Puerto Rico or larvae of an amitraz-susceptible *B. microplus* strain from Texas were sprayed with 0.025 percent amitraz, prepared from the emulsifiable concentrate formulation. Initial comparisons of the degree of control of the Puerto Rico and Texas ticks indicated that the strain of ticks from Puerto Rico was as susceptible to amitraz as the ticks from Texas. This test was repeated with the second laboratory generation of ticks from Puerto Rico and a known amitraz susceptible strain of *B. microplus* from Texas. Once again, the test results indicated that the ticks from Puerto Rico were fully susceptible to amitraz.

A 0.025 percent concentration of amitraz wettable powder (WP), applied by immersing cattle in a dipping vat, controlled 99.8 percent of the *B. annulatus* on the animals. In addition to the evaluation of efficacy, a study was performed with the assistance of APHIS, VS personnel to determine the stability of the amitraz WP in a dipping vat under South Texas conditions. During a period of about 1 month, 4,056 head of cattle were dipped in an amitraz-charged vat. Test results demonstrated that the active ingredient settled very rapidly in the freshly charged vat, but that the amitraz remained in suspension longer as the amount of contamination in the vat increased. There was a tendency for the amitraz concentration to increase slightly after each replenishment, but in general the evaluation demonstrated that in a ranch vat in which large numbers of cattle are being dipped, amitraz WP remains stable and the concentration of the active ingredient can be maintained at the targeted level.

Because of a need by tick eradication officials for an acaricide to prevent the hatching of larvae from eggs deposited on tick-infested premises, such as a sales yard, the ovicidal activity of coumaphos, diazinon, dioxathion, chlorpyrifos, and crotoxyphos against *B. microplus* eggs of different ages was determined. Test results proved that of the acaricides tested, only crotoxyphos, applied topically at a rate of 0.5 percent active ingredient, would provide sufficient ovicidal activity ($\geq$90 percent reduction in hatch) against eggs ranging in ages from 1 to 20 days for the compound to have value in premise cleanup activities.

Investigations to more precisely determine the suitability of white-tailed deer as alternate hosts for *B. annulatus* have

continued. Comparisons were made of the total number of adult female ticks recovered from deer and bovine hosts and of the associated ovipositional and reproductive parameters of these ticks. Significantly fewer ticks were recovered from deer (302) than from cattle (3,818). The difference was attributed to the more efficient grooming behavior of the deer. The mean weight of the female ticks collected from deer was significantly less than that of ticks from cattle (240.13 mg and 344.66 mg, respectively). About 15 percent of the engorged females recovered from the deer weighed less than 100 mg, and these ticks had probably been removed prematurely by grooming. A significant difference in the mean percent hatch of eggs from deer (65.22) and cattle (74.33) was observed. The index of reproduction (IR), a value that is based on the total number of engorged female ticks from a host, the mean weights of the egg masses from these females, and the mean percent hatch of the eggs was 19.7 times greater when cattle rather than white-tailed deer were hosts. It was concluded that the deer are biologically suitable hosts, but they are considerably less efficient host for *B. annulatus* than cattle.

The efficacy of a 20.2 percent emulsifiable concentrate formulation of the pyrethroid acaricide cyhalothrin was tested using two concentrations (0.007 percent and 0.01 percent) as a whole body spray against *B. microplus* on cattle. Based upon IR calculations, the 0.007 percent AI treatment provided 92.4 percent control and the 0.01 percent AI treatment provided 97.3 percent control. An evaluation of an "improved" cyhalothrin formulation has been scheduled.

Boophilus Tick Program in Texas

Tick eradication activities along the U.S.-Mexico border were successful in 1987. Thirty-four herds of Mexican livestock were apprehended by the Veterinary Services Tick Eradication Program employees along the Texas-Mexico border during this period. The herds totaled 26 cattle, of which 11 were infested with *Boophilus* ticks, and 22 horses which were free of cattle fever ticks. The total of 48 animals apprehended in 1987 compares to 74 Mexican animals apprehended in 1986.

The temporary preventative quarantine area in Cameron County was converted to a control purpose quarantine area to monitor livestock in the high-risk area. As a result, one premise was found infested with *Boophilus* ticks.

Three premises in the free area of Zapata County were found infested with cattle fever ticks in the vicinity of the previously infested Loma Llano Pasture. Range pasture conditions continued favorable due to adequate rainfall. Forage was abundant in most areas along the Texas-Mexico border.

Research Accomplishments for 1987 by *Animal Diseases Research Unit (ADRU),* USDA, Agricultural Research Service, Pullman, Washington, and Moscow, Idaho

Light and electron microscopes were used to obtain the first clear evidence that *Anaplasma marginale* infects tick salivary glands. Morphology of two strains of the parasite in salivary glands of three experimentally infected species of *Dermacentor* ticks suggests that the parasite replicates in this tissue before being introduced into cattle. If further studies confirm that the organism seen in the salivary glands represents the tick-transmitted stage of *A. marginale,* the antigenic profile of this stage can be characterized and unique antigens possibly included in a vaccine to protect cattle against tick-transmitted anaplasmosis.

A cloned DNA probe from the gene coding for an *A. marginale* surface polypeptide was used to detect *A. marginale* infections in individual tick tissues from three *Dermacentor* species. The DNA probe can detect all strains of *A. marginale* thus far tested, but does not cross-hybridize with *A. centrale* or *A. ovis. Anaplasma marginale* infection of *Dermacentor* tick salivary glands was confirmed with the DNA probe, revealing that the parasite was present before it could be detected microscopically and before it was infective for cattle.

Immunization of cattle with a purified *A. marginale* surface protein of 36,000 M.W. induced protection against both homologous and heterologous challenge. Cattle that did not develop infections were confirmed negative by DNA probe.

Experiments with unifested cattle and cattle infested with marked male/female *Dermacentor* ticks held together in indoor/outdoor pens revealed that approximately 30 percent of ticks recovered from the animals had transferred to new hosts. Interhost transfer by adult ticks may be an important means by which ticks transmit *A. marginale* in nature.

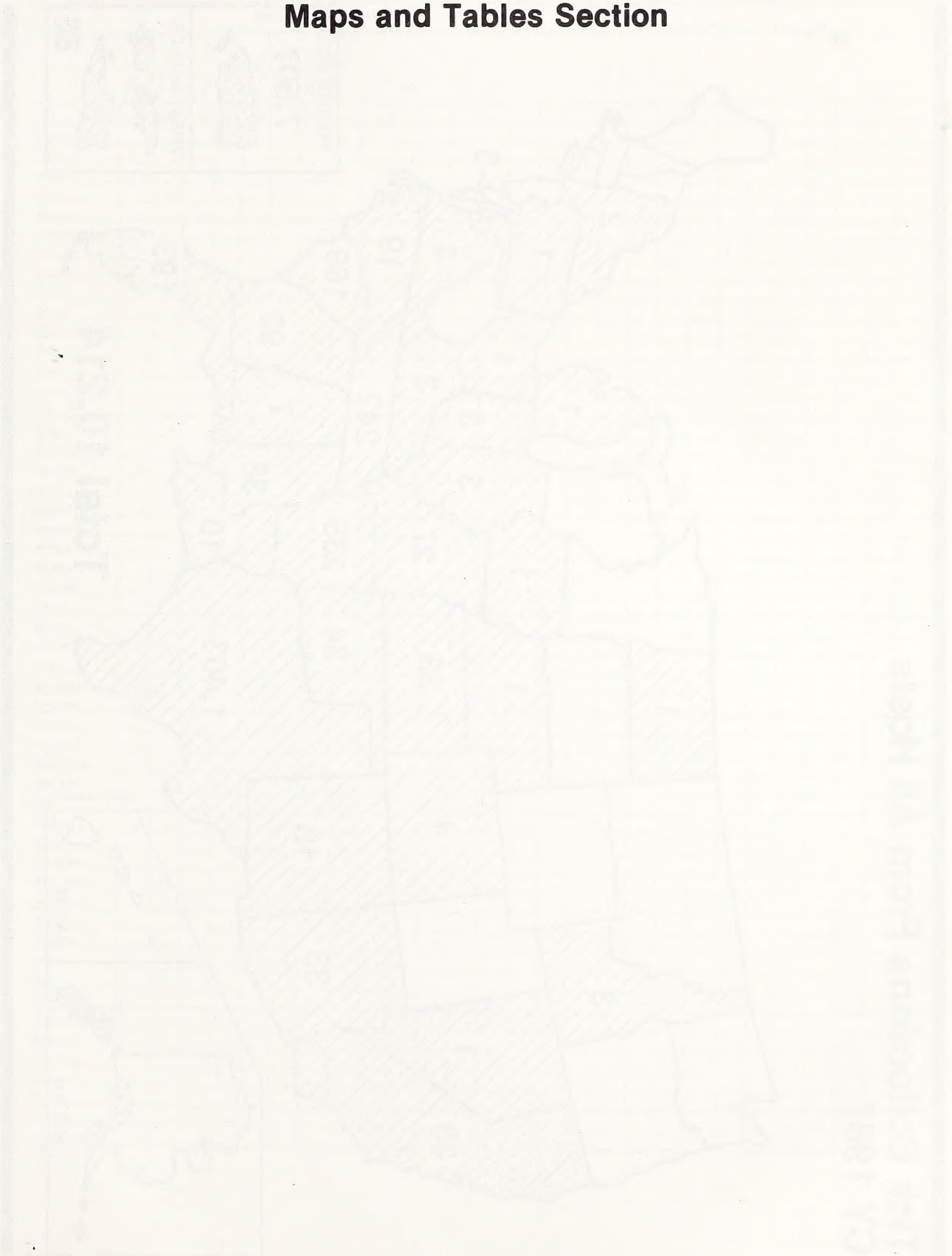
Anaplasma marginale-infected male *Dermacentor andersoni* held in packets off the host and in the field survived for 7 months and transmitted the parasite to susceptible calves after 121 days. The ticks appear to act as reservoirs of *A. marginale* through the summer and fall, but chronically infected vertebrate hosts appear to be the only significant overwintering reservoir of *A. marginale.*

Tick Identification and Vat Management Training Along United States-Mexico Border

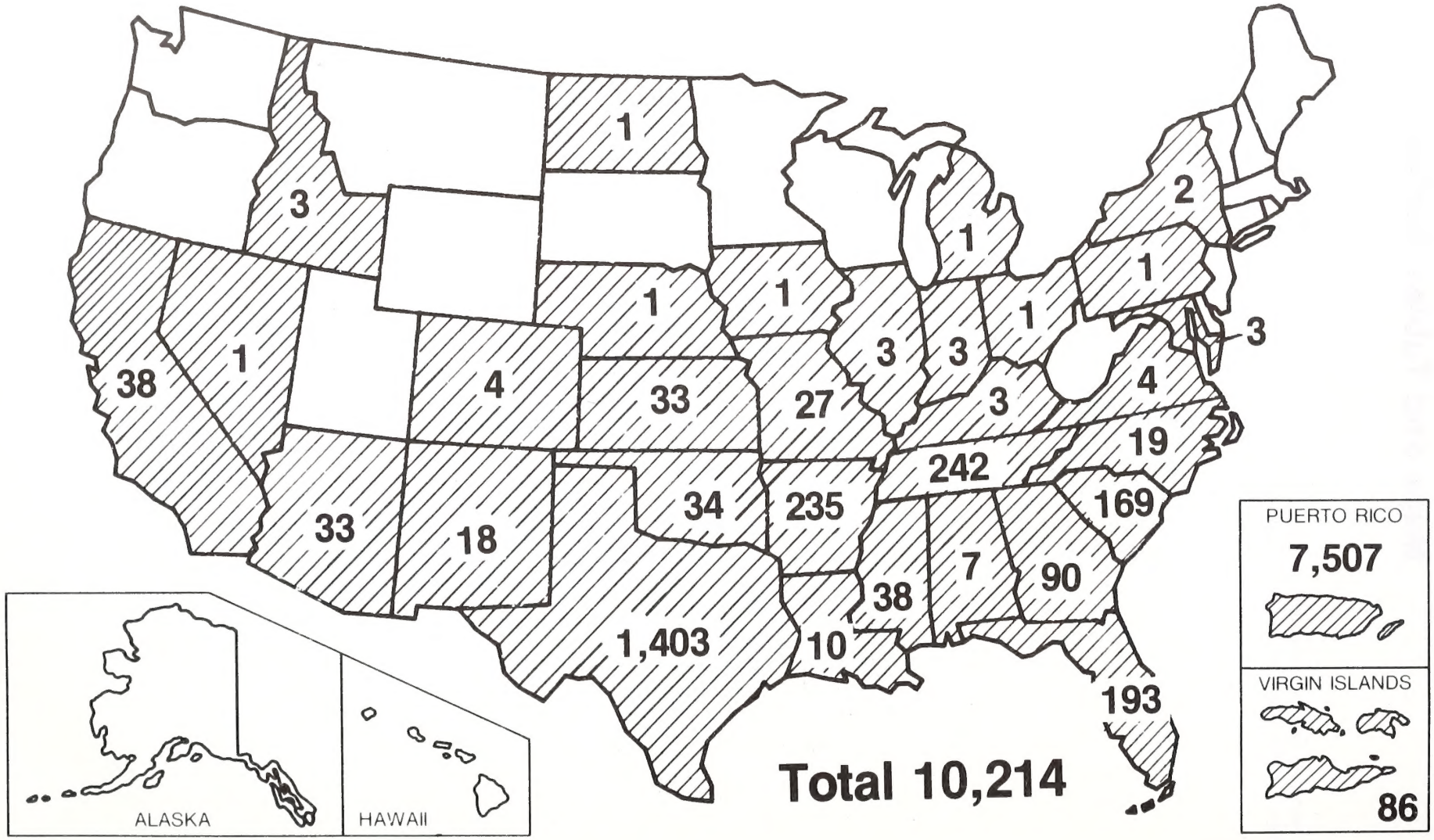
Tick identification and vat management training was conducted May 18 through June 6, 1987, for the personnel along the United States-Mexico border from Brownsville, Texas, to San Ysidro, California. The training included 52 State and Federal animal health personnel actively engaged

in the importation of livestock from Mexico. The training sites included Brownsville, Texas; Laredo, Texas; Del Rio, Texas; Presidio, Texas; El Paso, Texas; Nogales, Arizona; and San Ysidro, California. Personnel from all the ports along the United States-Mexico border were represented at the training locations.

Maps and Tables Section



Tick Collections From All Hosts
CY 1987



REPORT OF TICKS COLLECTED

USDA-APHIS

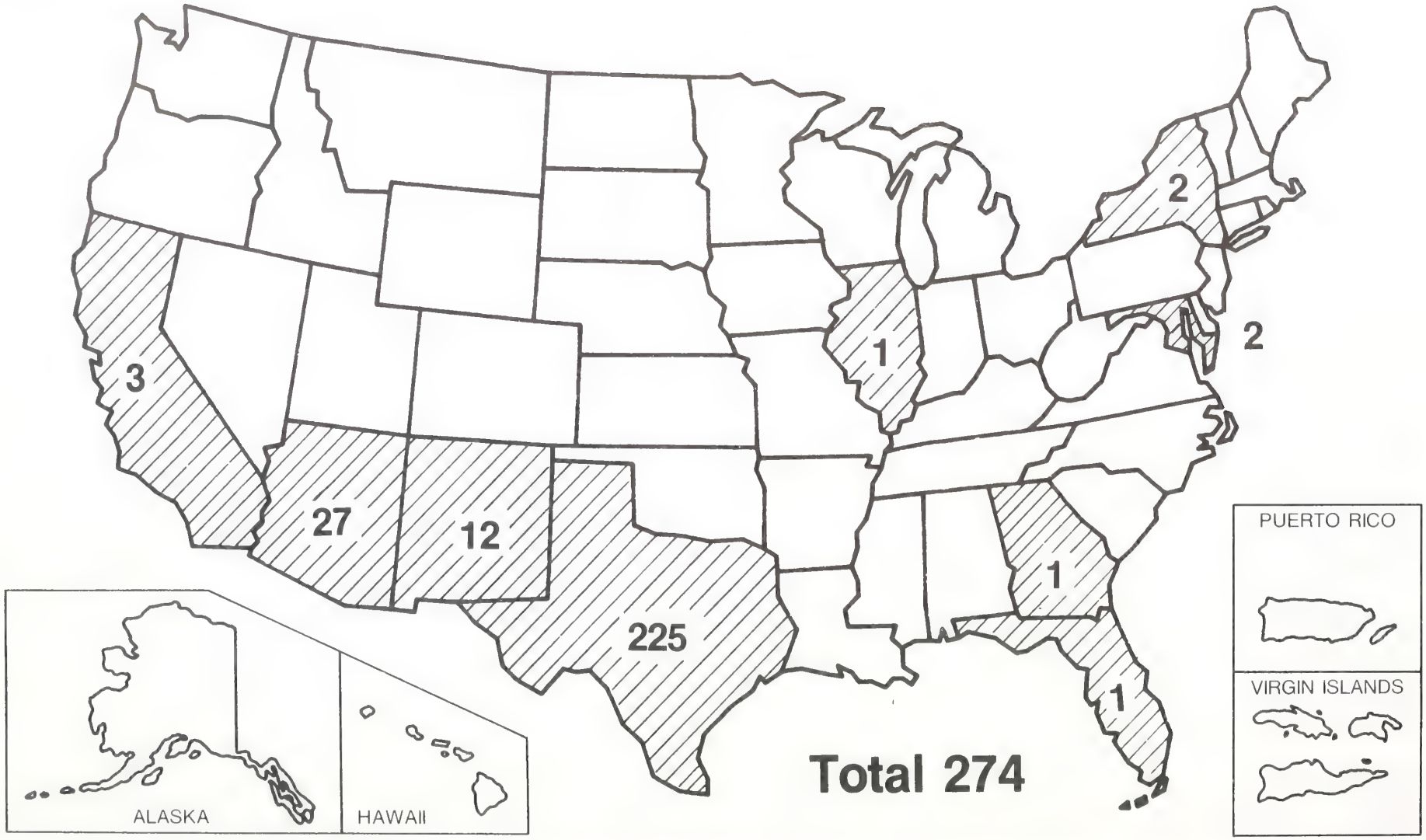
PERIOD: Calendar Year 1987

HOST: All Hosts

STATE	TOTAL	Cattle	Dogs	Horses & Mules	Zoo Animals & Misc. Hosts	Native Wildlife	Animals & Trap Deer Offered for Entry
TOTAL	10214	7099	203	2163	160	315	274
Alabama	7	7					
Alaska							
Arizona	33	1	1		4		27
Arkansas	235	205	6	1	2	21	
California	38	6	14		9	6	3
Colorado	4		3		1		
Connecticut							
Delaware							
Florida	193	117	37	20	3	15	1
Georgia	90	8	3		3	75	1
Hawaii							
Idaho	3	1	1			1	
Illinois	3		1	1			1
Indiana	3		2		1		
Iowa	1					1	
Kansas	33	29			1	3	
Kentucky	3	2			1		
Louisiana	10					10	
Maine							
Maryland	3				1		2
Massachusetts							
Michigan	1				1		
Minnesota							
Mississippi	38	27	9		2		
Missouri	27	23	4				
Montana							
Nebraska	1	1					
Nevada	1		1				
New Hampshire							
New Jersey							
New Mexico	18	2		1	3		12
New York	2						2
North Carolina	19	7	1			11	
North Dakota	1		1				
Ohio	1		1				
Oklahoma	34	22	1		1	10	
Oregon							
Pennsylvania	1			1			
Rhode Island							
South Carolina	169	11	16		11	131	
South Dakota							
Tennessee	242	207	13	1	18	3	
Texas	1403	726	83	310	31	28	225
Utah							
Vermont							
Virginia	4	4					
Washington							
West Virginia							
Wisconsin							
Wyoming							
Puerto Rico	7507	5660	2	1793	52		
Virgin Islands	86	33	3	35	15		

VS FORM T-4
(APR 84)

Tick Collections From Animals and Products Offered For Entry CY 1987



REPORT OF TICKS COLLECTED

USDA-APHIS

PERIOD: Calendar Year 1987

HOST: Animals and Products Offered for Entry

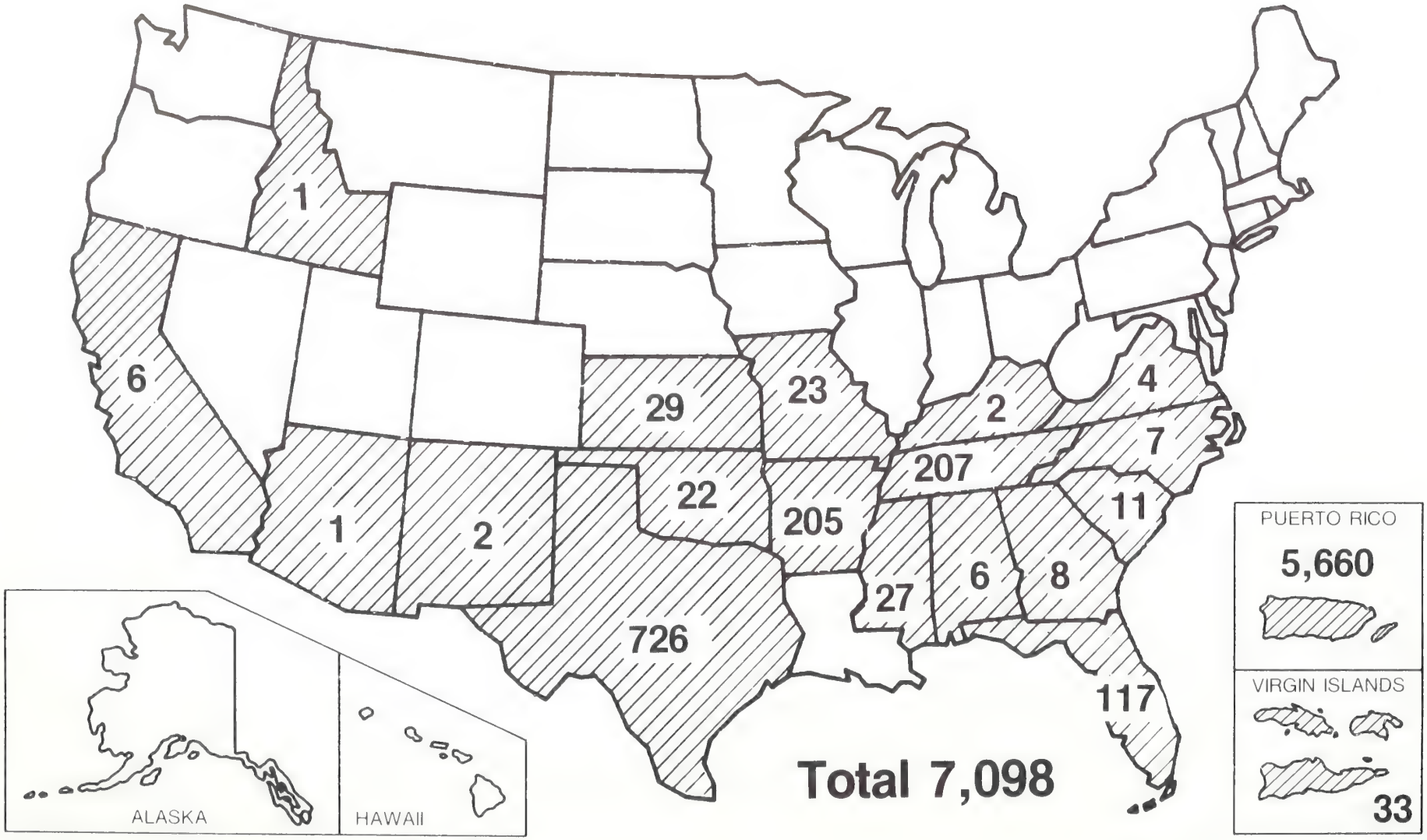
STATE	TOTAL	AMBLYOMMA AMERICANUM	AMBLYOMMA CAJENNENSE	AMBLYOMMA IMITATOR	AMBLYOMMA MACULATUM	AMBLYOMMA SPP	ARGAS PERSICUS	BOOPHILUS ANNULATUS	BOOPHILUS MICROPLUS	BOOPHILUS SPP.	DERMACENTOR ALBIPICTUS	DERMACENTOR SILVARUM (= D. PICTUS, D. LEVIS & D. PARUMA)	DERMACENTOR NITENS	DERMACENTOR OCCIDENTALIS	DERMACENTOR VARIABILIS	DERMACENTOR SPP	HAEMAPHYSALIS LEPORISPALUSTRIS	IXODES COOKEI	IXODES PACIFICUS	IXODES SCAPULARIS	IXODES SPP.	ORNITHODOROS SPP.	OTOBIUS MEGNINI	RHIPICEPHALUS SANGUINEUS	RHIPICEPHALUS SPP.	MISCELLANEOUS SPP.
TOTAL	274		15	3	2	4		26	115	22	53		2	3		3	10			1			8	5		2
ARIZONA																										
Douglas	12										10BO						2BO*									
Nogales	15										9BO												6BO			
CALIFORNIA																										
San Ysidro	3							2BO															1BO			
FLORIDA																										
Miami	1													1HO												
GEORGIA																										
Atlanta	1					1TH[h]																				
ILLINOIS																										
Chicago	1								1PL																	
MARYLAND																										
Baltimore	2																							2X		
NEW MEXICO																										
Columbus	12										11BO		1BO													
NEW YORK																										
Rock Tavern	2																									1 OS[ht] 1BI[hy]
TEXAS																										
Brownsville	9		2BO						5BO	1BO*														1DG		
Del Rio	41		1BO			1BO		1BO	24BO	2BO 5BO*	4BO						3BO*									
Eagle Pass	51		3BO			1BO*		2BO	23BO	3BO 6BO*	6BO		1BO			2BO	3BO*			1BO						
El Paso	1								1BO																	
Hidalgo	2							1BO	1BO																	
Laredo	99		9BO	3BO	2BO	1BO		13BO /DH	54BO	4BO* 1BO	1BO			2BO		1BO							1BO			
Presidio	22								6BO		12BO						2BO*							2BO[h]		

Key to Host
BO Cattle
DG Dog
DH Deer Hide
HO Horse
OS Ostrich
PL Plant
X Inanimate Object

Key to Species
h Amblyomma hebraeum
hy Hyalomma sp.
ht Hyalomma truncatum

* Nymphal Stage

Tick Collections From Cattle
CY 1987



REPORT OF TICKS COLLECTED

USDA-APHIS | PERIOD: Calendar Year | HOST: Cattle

STATE	TOTAL	AMBLYOMMA AMERICANUM	AMBLYOMMA CALENNINSE	AMBLYOMMA IMITATOR	AMBLYOMMA MACULATUM	AMBLYOMMA SPP.	ARGAS PERSICUS	BOOPHILUS ANNULATUS	BOOPHILUS MICROPLUS	BOOPHILUS SPP.	DERMACENTOR ALBIPICTUS	DERMACENTOR SIGNATUS (VARIABILIS & VENUSTUS BANKS)	DERMACENTOR NIGROLINEATUS	DERMALENTOR LITERS	DERMACENTOR OCCIDENTALIS	DERMACENTOR VARIABILIS	DERMACENTOR SPP	HAEMAPHYSALIS LEPORISPALUSTRIS	IXODES COOKEI	IXODES PACIFICUS	IXODES SCAPULARIS	IXODES SPP.	ORNITHODOROS SPP.	OTOBIUS MEGNINI	RHIPICEPHALUS SANGUINEUS	RHIPICEPHALUS SPP.	MISCELLANEOUS SPP.
TOTAL	7098	471	111	4	269	30		5	5340	4	45		15	353		360	2				44			41	4		
Alabama	6	5														1											
Alaska																											
Arizona	1										1																
Arkansas	205	165														13					27						
California	6										2													4			
Colorado																											
Connecticut																											
Delaware																											
Florida	117	13			83											14					6				1		
Georgia	8	5			2											1											
Hawaii																											
Idaho	1										1																
Illinois																											
Indiana																											
Iowa																											
Kansas	29	3			21											5											
Kentucky	2															2											
Louisiana																											
Maine																											
Maryland																											
Massachusetts																											
Michigan																											
Minnesota																											
Mississippi	27	14			4								1			6					1				1		
Missouri	23	8														14					1						
Montana																											
Nebraska	1															1											
Nevada																											
New Hampshire																											
New Jersey																											
New Mexico	2										2																
New York																											
North Carolina	7															7											
North Dakota																											
Ohio																											
Oklahoma	22	13											1								5			3			
Oregon																											
Pennsylvania																											
Rhode Island																											
South Carolina	11	1											2			8											
South Dakota																											
Tennessee	207	84			1											121									1		
Texas	726	158	111	4	158	11[I] 6*		5	12	4	39		11	2		165	1[P] 1*				4			34			
Utah																											
Vermont																											
Virginia	4	2														2											
Washington																											
West Virginia																											
Wisconsin																											
Wyoming																											
Puerto Rico	5660					2[V]			5307					350											1		
Virgin Islands	33					11[V]			21					1													

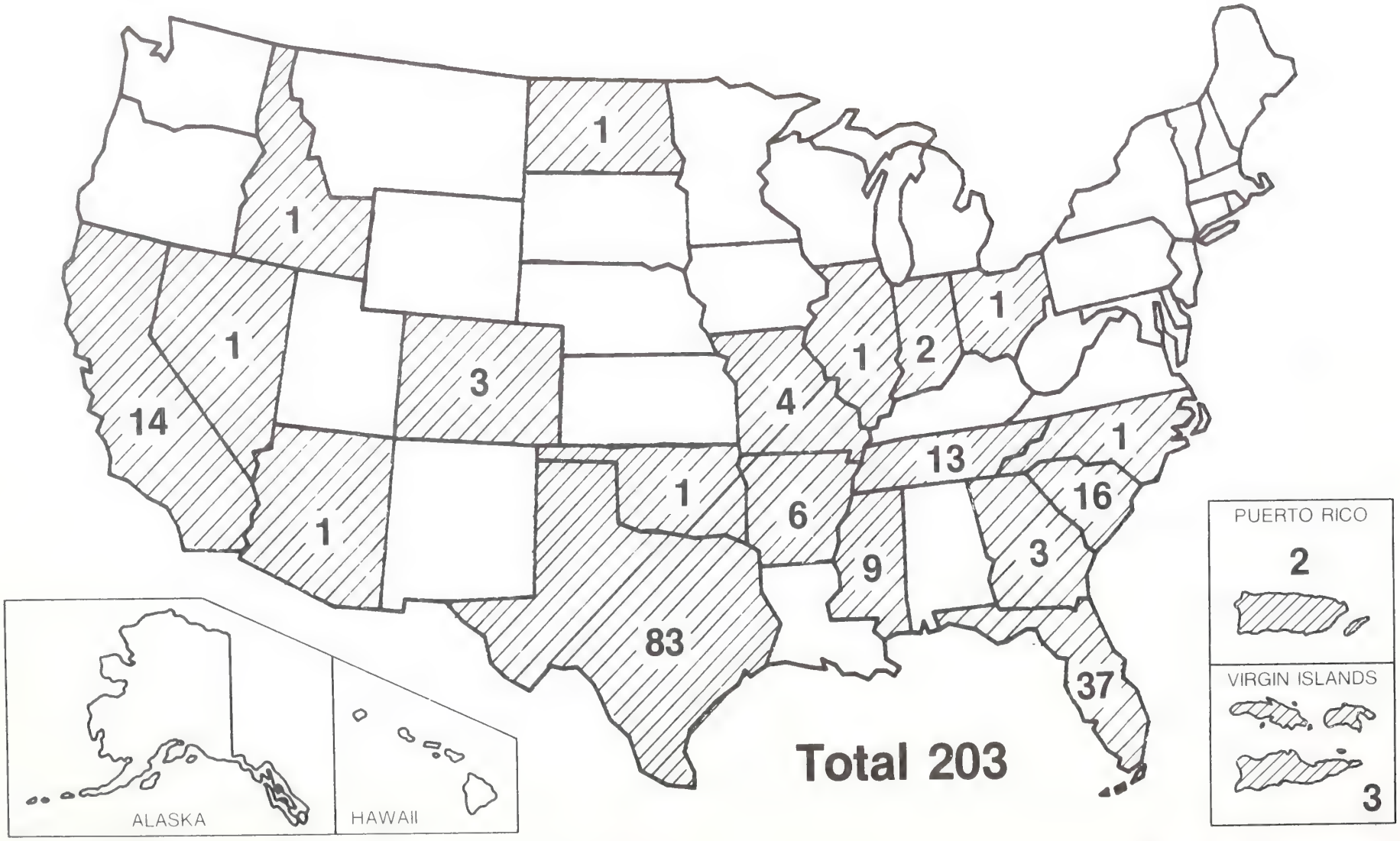
VS FORM T-4 (APR 84)

Key to Species

I Amblyomma inornatum
p Dermacentor parumapertus
v Amblyomma variegatum

* Nymphal Stage

Tick Collections From Dogs
CY 1987



REPORT OF TICKS COLLECTED

USDA-APHIS

PERIOD: Calendar Year 1987

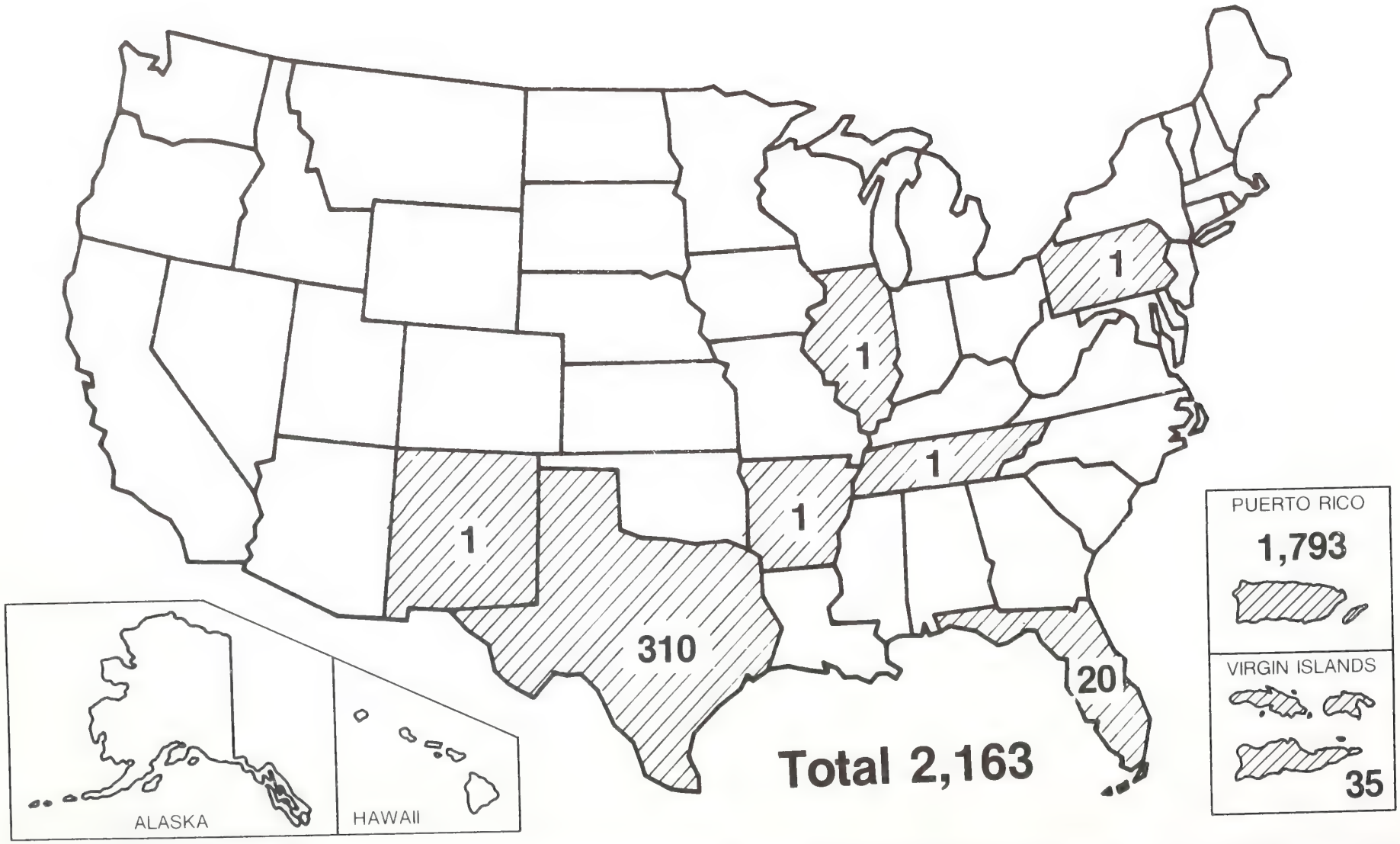
HOST: Dogs

STATE	TOTAL	AMBLYOMMA AMERICANUM	AMBLYOMMA CAJENNENSE	AMBLYOMMA IMITATOR	AMBLYOMMA MACULATUM	AMBLYOMMA SPP.	ARGAS PERSICUS	BOOPHILUS ANNULATUS	BOOPHILUS MICROPLUS	BOOPHILUS SPP.	DERMACENTOR ALBIPICTUS	DERMACENTOR OCCIDENTALIS VARIABILIS VENUSTUS OR SIMILIS	DERMACENTOR NITIDULATUS	DERMACENTOR NITENS	DERMACENTOR OCCIDENTALIS	DERMACENTOR VARIABILIS	DERMACENTOR SPP.	HAEMAPHYSALIS LEPORIS PALUSTRIS	IXODES COOKEI	IXODES PACIFICUS	IXODES SCAPULARIS	IXODES SPP.	ORNITHODORUS SPP.	OTOBIUS MEGNINI	RHIPICEPHALUS SANGUINEUS	RHIPICEPHALUS SPP.	MISCELLANEOUS SPP.
TOTAL	203	21			14	1					3				83			1	1	24			1	54		
Alabama																											
Alaska																											
Arizona	1				1																						
Arkansas	6														3									3			
California	14										1				7				1				1	4			
Colorado	3										2													1			
Connecticut																											
Delaware																											
Florida	37	1			9										5					21				1			
Georgia	3	1													2												
Hawaii																											
Idaho*	1														1												
Illinois	1														1												
Indiana	2														2												
Iowa																											
Kansas																											
Kentucky																											
Louisiana																											
Maine																											
Maryland																											
Massachusetts																											
Michigan																											
Minnesota																											
Mississippi	9	2			1										3									3			
Missouri	4														3				1								
Montana																											
Nebraska																											
Nevada	1																							1			
New Hampshire																											
New Jersey																											
New Mexico																											
New York																											
North Carolina	1																							1			
North Dakota	1														1												
Ohio	1																							1			
Oklahoma	1																				1						
Oregon																											
Pennsylvania																											
Rhode Island																											
South Carolina	16	1			2										6					2				5			
South Dakota																											
Tennessee	13	3													9									1			
Texas	83	13			1	1*									40									28			
Utah																											
Vermont																											
Virginia																											
Washington																											
West Virginia																											
Wisconsin																											
Wyoming																											
Puerto Rico	2																							2			
Virgin Islands	3																							3			

VS FORM T-4 (APR 84)

* Nymphal Stage

Tick Collections From Horses and Mules
CY 1987



REPORT OF TICKS COLLECTED

USDA-APHIS

PERIOD: Calendar Year 1987

HOST: Horses and Mules

STATE	TOTAL	AMBLYOMMA AMERICANUM	AMBLYOMMA CAJENNENSE	AMBLYOMMA IMITATOR	AMBLYOMMA MACULATUM	AMBLYOMMA SPP.	ARGAS PERSICUS	BOOPHILUS ANNULATUS	BOOPHILUS MICROPLUS	BOOPHILUS SPP.	DERMACENTOR ALBIPICTUS	DERMACENTOR ANDERSONI STILESI	DERMACENTOR NITENS (= D. TAIWANICA BANKS)	DERMACENTOR NIGROLINEATUS	DERMACENTOR VARIABILIS	DERMACENTOR OCCIDENTALIS	DERMACENTOR VARIABILIS	DERMACENTOR SPP	HAEMAPHYSALIS LEPORIS-PALUSTRIS	IXODES COOKEI	IXODES PACIFICUS	IXODES SCAPULARIS	IXODES SPP.	ORNITHODORUS SPP.	OTOBIUS MEGNINI	RHIPICEPHALUS SANGUINEUS	RHIPICEPHALUS SPP.	MISCELLANEOUS SPP.
TOTAL	2163	6	17	3	37	15		32		2		1	1797		246						6				1			
Alabama																												
Alaska																												
Arizona																												
Arkansas	1	1																										
California																												
Colorado																												
Connecticut																												
Delaware																												
Florida	20				3								9		2						6							
Georgia																												
Hawaii																												
Idaho																												
Illinois	1														1													
Indiana																												
Iowa																												
Kansas																												
Kentucky																												
Louisiana																												
Maine																												
Maryland																												
Massachusetts																												
Michigan																												
Minnesota																												
Mississippi																												
Missouri																												
Montana																												
Nebraska																												
Nevada																												
New Hampshire																												
New Jersey																												
New Mexico	1										1																	
New York																												
North Carolina																												
North Dakota																												
Ohio																												
Oklahoma																												
Oregon																												
Pennsylvania	1																								1			
Rhode Island																												
South Carolina																												
South Dakota																												
Tennessee	1														1													
Texas	310	5	17	3	34	1*		1		1		1	5		242													
Utah																												
Vermont																												
Virginia																												
Washington																												
West Virginia																												
Wisconsin																												
Wyoming																												
Puerto Rico	1793							28					1765															
Virgin Islands	35					14[V]		3					18															

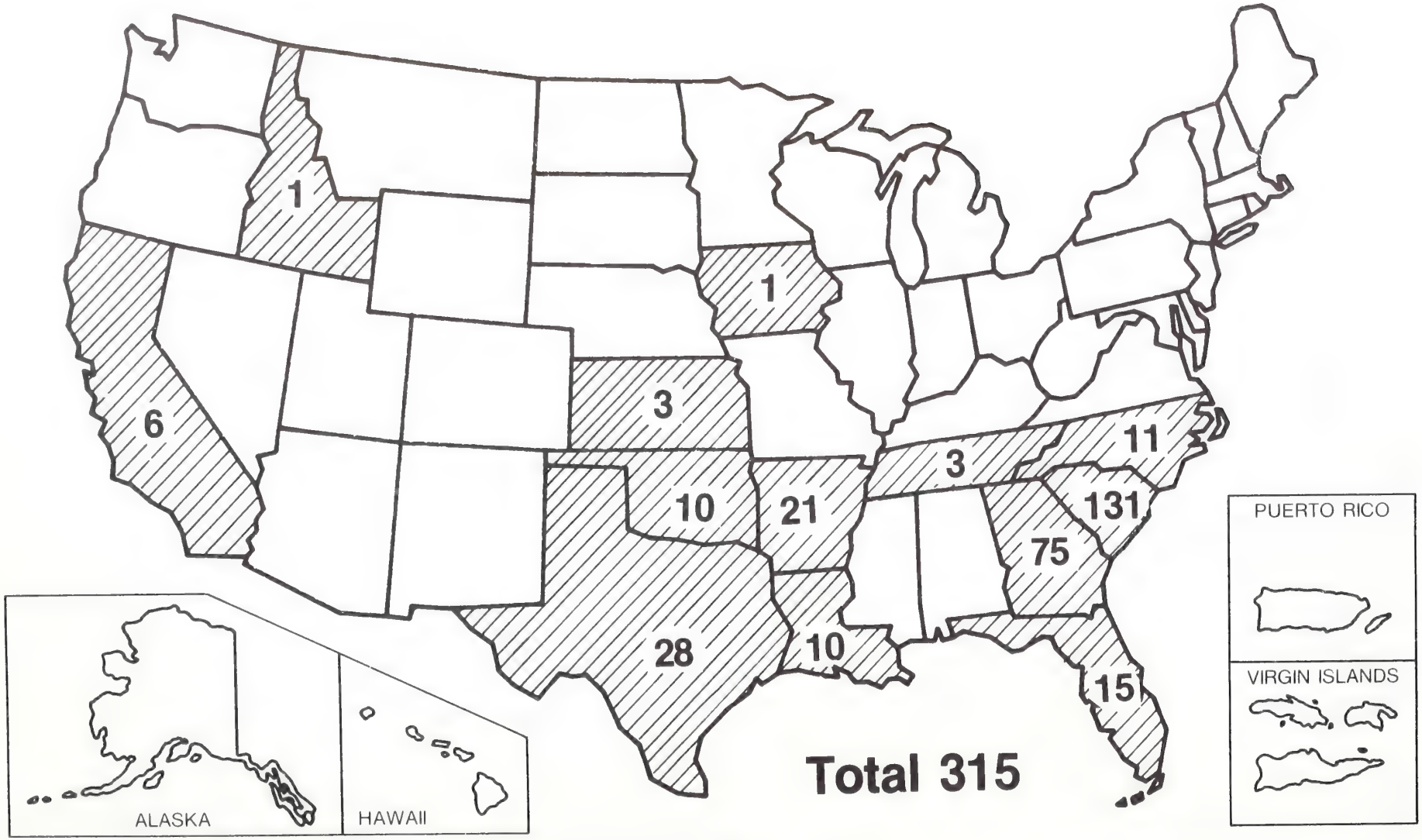
VS FORM T-4 (APR 84)

Key to Species

* Nymphal Stage

[V] Amblyomma variegatum

Tick Collections From Native Wildlife
CY 1987



REPORT OF TICKS COLLECTED

USDA-APHIS | PERIOD: Calendar Year 1987 | HOST: Native Wildlife

STATE	TOTAL	AMBLYOMMA AMERICANUM	AMBLYOMMA CAJENNENSE	AMBLYOMMA IMITATOR	AMBLYOMMA MACULATUM	AMBLYOMMA SPP.	ARGAS PERSICUS	BOOPHILUS ANNULATUS	BOOPHILUS MICROPLUS	BOOPHILUS SPP.	DERMACENTOR ALBIPICTUS	DERMACENTOR SILVARUM, D. ANDERSONI, D. EQUESTRIS & D. VENUSTUS	DERMACENTOR NITENS	DERMACENTOR SPP.	DERMACENTOR VARIABILIS	HAEMAPHYSALIS LEPORISPALUSTRIS	IXODES CookEI	IXODES PACIFICUS	IXODES SCAPULARIS	IXODES SPP.	ORNITHODOROS SPP.	OTOBIUS MEGNINI	RHIPICEPHALUS SANGUINEUS	RHIPICEPHALUS SPP.	MISCELLANEOUS SPP.
TOTAL	315	115	1		20	1			1		3		12		2	50		19	11	1	56	21		2				
Alabama																											
Alaska																											
Arizona																											
Arkansas	21	15D																			4D			2D			
California	6										1D 1E				2D	1BB				1D							
Colorado																											
Connecticut																											
Delaware																											
Florida	15	6D			6D																2D 1F						
Georgia	75	1GF 4RC 34D			1CO 2D											1BB 1CO 2GF 1R	1R 1RC	1GF 6RC 1SK			1CO	1RC[id] 3RC[x]						
Hawaii																1 OP 1ORC 2RF											
Idaho	1										1D																
Illinois																											
Indiana																											
Iowa	1																					1RC[x]					
Kansas	3															1RC						1R[u] 1RC[x]					
Kentucky																											
Louisiana	10	10D																									
Maine																											
Maryland																											
Massachusetts																											
Michigan																											
Minnesota																											
Mississippi																											
Missouri																											
Montana																											
Nebraska																											
Nevada																											
New Hampshire																											
New Jersey																											
New Mexico																											
New York																											
North Carolina	11	1CC 5D																				4D[a] 1BI[b]					
North Dakota																											
Ohio																											
Oklahoma	10	1CO 1D											1D						1MK		1BC 2CO 1MK 1RF 1D						
Oregon																											
Pennsylvania																											
Rhode Island																											
South Carolina	131	17D 19RC 1WT			6D	1CO[t]							10D			1BC 3D 23RC		1RC			40D 1GF	5D[a] 3RC[x]					
South Dakota																											
Tennessee	3															1R			2RC								
Texas	28		1D		5D				1D				1D			1CO 1D		15R 1D			1D	1D[u]					
Utah																											
Vermont																											
Virginia																											
Washington																											
West Virginia																											
Wisconsin																											
Wyoming																											
Puerto Rico																											
Virgin Islands																											

VS FORM T-4 (APR 84)

Key to Host

BB	Black Bear	E	Elk	RC	Racoon
BC	Bobcat	F	Fox	RF	Red Fox
BI	Bird	GF	Grey Fox	SK	Skunk
CG	Cougar	MK	Mink	WT	Wild Turkey
CO	Coyote	OP	Opossum		
D	Deer	R	Rabbit		

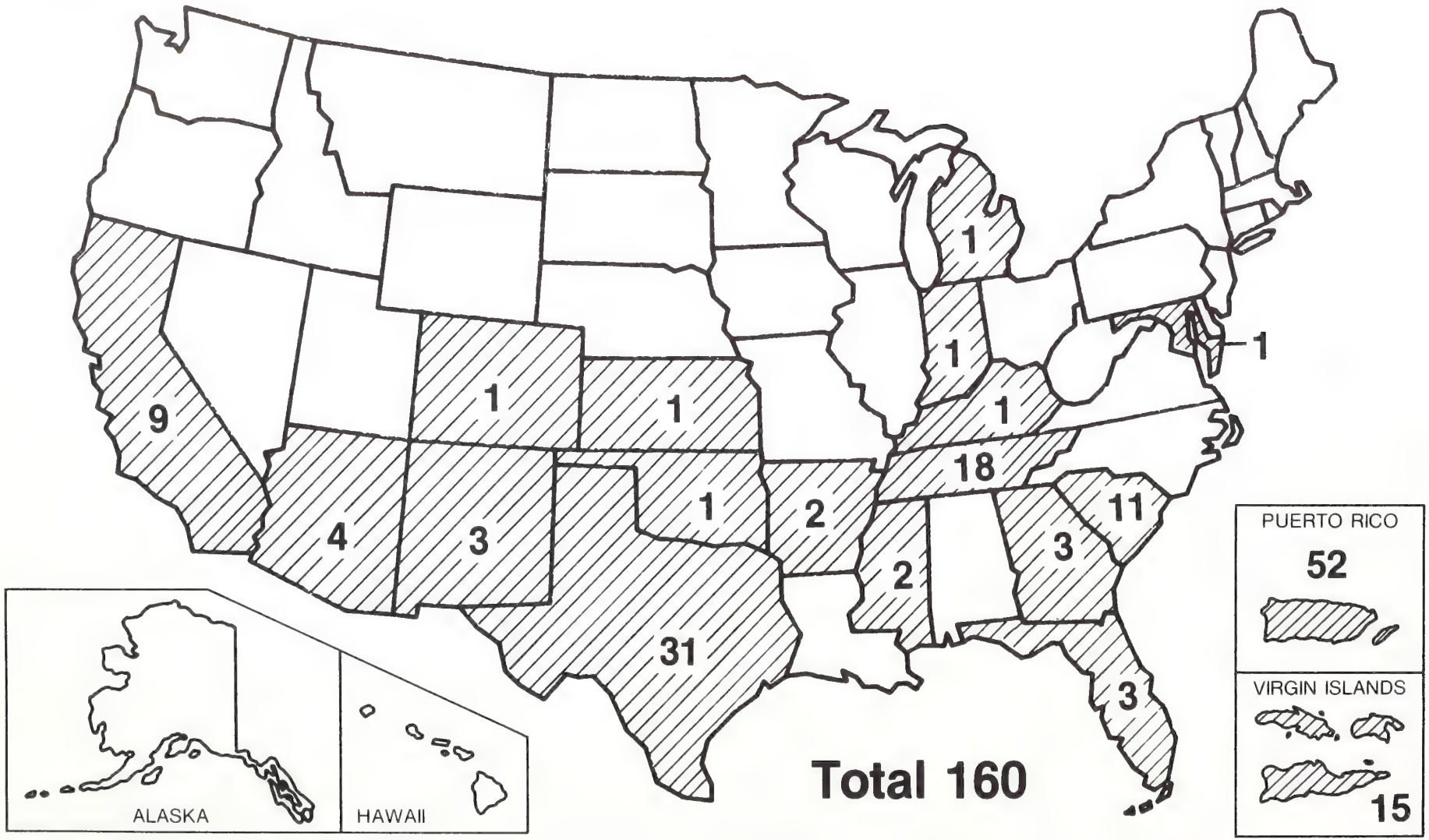
Key to Species

a	Ixodes affinis
b	Ixodes brunneus
id	Ixodes dentatus
t	Amblyomma tuberculatum

** Larval Stage

u	Ixodes (species undetermined)
x	Ixodes texanus

Tick Collections From Zoo Animals And Miscellaneous Hosts CY 1987



REPORT OF TICKS COLLECTED

USDA-APHIS

PERIOD: Calendar Year 1987

HOST: Zoo Animals and Miscellaneous Hosts

STATE	TOTAL	AMBLYOMMA AMERICANUM	AMBLYOMMA CAJENNENSE	AMBLYOMMA IMITATOR	AMBLYOMMA MACULATUM	AMBLYOMMA SPP.	ARGAS PERSICUS	BOOPHILUS ANNULATUS	BOOPHILUS MICROPLUS	BOOPHILUS SPP.	DERMACENTOR ALBIPICTUS	DERMACENTOR ANDERSONI (INCLUDES OCCIDENTALIS & SIGNATUS of BANKS)	DERMACENTOR NITENS	DERMACENTOR OCCIDENTALIS	DERMACENTOR PARUMAPERTUS	DERMACENTOR SPP.	HAEMAPHYSALIS LEPORISPALUSTRIS	IXODES COOKEI	IXODES PACIFICUS	IXODES SCAPULARIS	IXODES SPP.	ORNITHODOROS SPP.	OTOBIUS MEGNINI	RHIPICEPHALUS SANGUINEUS	RHIPICEPHALUS SPP.	MISCELLANEOUS SPP.
TOTAL	160	20	3		5	17	1		36				6	21	1	28		1	1	6	3	1		1	6	1	2
Alabama																											
Alaska																											
Arizona	4					1IG[d]																			1X	1TH[e]	1TH[ht]
Arkansas	2	1X 1Q																									
California	9					1RH[te]									1Y	1H				6Y							
Colorado	1					1TH[h]																					
Connecticut																											
Delaware																											
Florida	3				1Q											1Y					1C						
Georgia	3	1Q														1Q									1Q		
Hawaii																											
Idaho																											
Illinois																											
Indiana	1															1H											
Iowa																											
Kansas	1															1H											
Kentucky	1															1Y											
Louisiana																											
Maine																											
Maryland	1																										1B[al]
Massachusetts																											
Michigan	1																		1H								
Minnesota																											
Mississippi	2	1H														1Q											
Missouri																											
Montana																											
Nebraska																											
Nevada																											
New Hampshire																											
New Jersey																											
New Mexico	3																								1X 2Q		
New York																											
North Carolina																											
North Dakota																											
Ohio																											
Oklahoma	1																				1C						
Oregon																											
Pennsylvania																											
Rhode Island																											
South Carolina	11	1Q 2TR 1TD														2TR 2H 1Y					1Q	1Q[a]					
South Dakota																											
Tennessee	18	3H 5Q														2G 7Q									1Q		
Texas	31	2SD 1H	3Q		4Q	2LT[m] 1AE[n]	1FW						1AD 3FD			1H 3Y	1SD						1AD				
Utah		1Q				1ST[c]							2SD			3Q											
Vermont																											
Virginia																											
Washington																											
West Virginia																											
Wisconsin																											
Wyoming								1S						2S													
Puerto Rico	52							24Q 10G						5Q 10G													
Virgin Islands	15					8CH[v] 2MN[v]		1G						3G 1S													

VS FORM T-4 (APR 84)

KEY TO HOSTS

AD	Axis Deer	FW	Fowl	Q	Host Not Given
AE	Anteater	G	Goat	RH	Rhinoceros
B	Boa	H	Human	S	Sheep
C	Cat	IG	Iguana	SD	Sika Deer
CH	Chicken	LT	Leopard Tortoise	ST	Star Tortoise
FD	Fallow Deer	MN	Mongoose	TD	Tick Drag
TH	Trophy Hide				
TR	CO2 Trap				
X	Inanimate Object				
Y	Swine				

KEY TO SPECIES (superscripts)

a	Ixodes affinis	ht	Hyalomma truncatum
al	Amblyomma latum	m	Amblyomma marmoreum
c	Amblyomma clypeolatum	n	Amblyomma nodosum
d	Amblyomma dissimile	te	Amblyomma testudinarium
e	Rhipicephalus evertsi	v	Amblyomma variegatum
h	Amblyomma hebraeum		

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